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HARBOR SEAL (*Phoca vitulina richardsi*): Oregon/Washington Coast Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Harbor seals inhabit coastal and estuarine waters off Baja California, north along the western coasts of the continental U.S., British Columbia, and Southeast Alaska, west through the Gulf of Alaska and Aleutian Islands, and in the Bering Sea north to Cape Newenham and the Pribilof Islands. They haul out on rocks, reefs, beaches, and drifting glacial ice, and feed in marine, estuarine, and occasionally fresh waters. Harbor seals generally are non-migratory, with local movements associated with such factors as tides, weather, season, food availability, and reproduction (Scheffer and Slipp 1944; Fisher 1952; Bigg 1969, 1981). Harbor seals do not make extensive pelagic migrations though some long distance movement of tagged animals in Alaska (174 km) and along the U.S. west coast (up to 550 km) have been recorded (Pitcher and McAllister 1981, Brown and Mate 1983, Herder 1986). Harbor seals have also displayed strong fidelity for haul out sites (Pitcher and Calkins 1979, Pitcher and McAllister 1981).

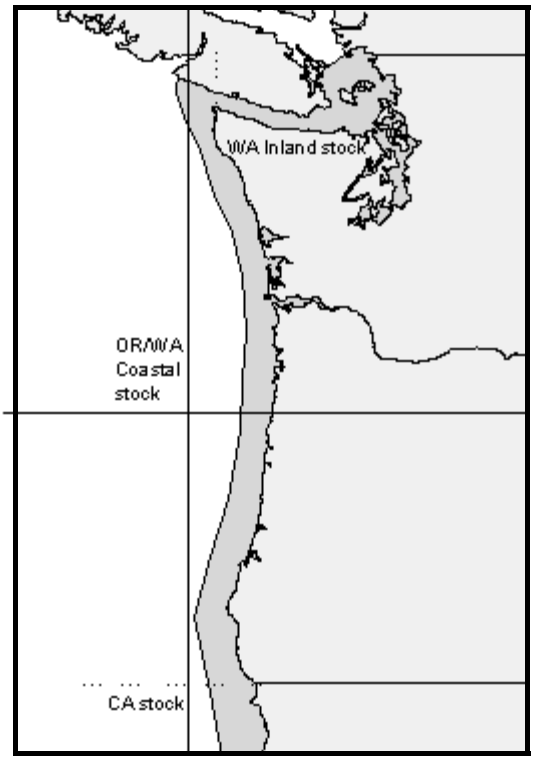

Figure 1. Approximate distribution of harbor seals in the U.S. Pacific Northwest (shaded area). Stock boundaries separating the three stocks are shown.

For management purposes, differences in mean pupping date (Temte 1986), movement patterns (Jeffries 1985, Brown 1988), pollutant loads (Calambokidis et al. 1985) and fishery interactions have led to the recognition of 3 separate harbor seal stocks along the west coast of the continental U.S. (Boveng 1988): 1) inland waters of Washington State (including the Hood Canal, Puget Sound, and Strait of Juan de Fuca out to Cape Flattery), 2) outer coast of Oregon and Washington, and 3) California (see Fig. 1). Recent genetic analyses provide additional support for this stock structure (Huber et al. 1994, Burg 1996, Lamont et al. 1996). Samples from Washington, Oregon, and California demonstrate a high level of genetic diversity and indicate that the harbor seals of inland Washington possess unique haplotypes not found in seals from the coasts of Washington, Oregon, and California (Lamont et al. 1996). This report considers only the Oregon/Washington Coast stock. Three harbor seal stocks are also recognized in the inland and coastal waters of Alaska, including the Southeast Alaska, Gulf of Alaska, and Bering Sea stocks. The three Alaska harbor seal stocks are reported separately in the Stock Assessment Reports for the Alaska Region.

POPULATION SIZE

Aerial surveys of harbor seals in Oregon and Washington were conducted by personnel from the National Marine Mammal Laboratory (NMML) and the Oregon and Washington Departments of Fish and Wildlife (ODFW and WDFW) during the 1997 pupping season. Total numbers of hauled-out seals (including pups) were counted during these surveys. In 1997, the mean count of harbor seals occurring along the Washington coast was 11,864 (CV=0.028) animals (WDFW, unpubl. data; NMML, unpubl. data). In 1997, the mean count of harbor seals occurring along the Oregon coast and in the Columbia River was 5,247 (CV=0.042) animals (ODFW, unpubl. data; Brown 1997). Combining these counts results in 17,111 (CV=0.023) harbor seals in the Oregon/Washington Coast stock.

Radio-tagging studies conducted at 6 locations (3 Washington inland waters sites and 3 Oregon and Washington coastal sites) collected information on haulout pattern from 63 harbor seals in 1991 and 61 harbor seals in 1992. Data from coastal and inland sites were not significantly different and were thus pooled, resulting in a correction factor of 1.53 (CV=0.065) to account for animals in the water which are missed during the aerial surveys (Huber 1995). Using this correction factor results in a population estimate of 26,180 (17,111 x 1.53; CV=0.069) for the Oregon/Washington Coast

stock of harbor seals in 1997 (WDFW, unpubl. data; NMML, unpubl. data; ODFW, unpubl. data).

Minimum Population Estimate

The log-normal 20th percentile of the 1997 population estimate for this stock is 24,705 harbor seals.

Current Population Trend

Historical levels of harbor seal abundance in Oregon and Washington are unknown. The population apparently decreased during the 1940s and 1950s due to bounty hunting. Approximately 17,133 harbor seals were killed in Washington by bounty hunters between 1943 and 1960 (Newby 1973). More than 3,800 harbor seals were killed in Oregon between 1925 and 1972 by a state-hired seal hunter, as well as bounty hunters (Pearson 1968). The population remained relatively low during the 1960s, but since the termination of the harbor seal bounty program and with the protection provided by the Marine Mammal Protection Act (MMPA) harbor seal counts for this stock have increased from 6,389 in 1977 to 17,111 in 1997 (WDFW, unpubl. data; NMML, unpubl. data; ODFW, unpubl. data).

Between 1983 and 1996, the annual rate of increase for this stock was 4%, with the peak count of 18,667 seals occurring in 1992. From 1991 to 1996, however, this stock declined 1.6% ($t=3.25$; $p=0.083$) annually (Jeffries et al. 1997), which may indicate that this population has exceeded equilibrium levels. Analyzing only the Oregon data (average annual rate of increase was 0.3% from 1988-96) indicates that the Oregon segment of the stock may be approaching equilibrium (Brown 1997). It is possible that the lower total counts for the population as a whole may have resulted from changes in haulout behavior. Increased disturbance, reduced food availability necessitating longer foraging periods, or other unknown reasons may have caused a larger number of seals to be in the water during the surveys (Jeffries et al. 1997).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

From 1978 to 1993, counts of harbor seals throughout Washington State increased at an annual rate of 7.68% (Huber 1995). The Oregon/Washington Coast harbor seal stock increased at an annual rate of 7% from 1983 to 1992 and at 4% from 1983 to 1996 (Jeffries et al. 1997). Because the population was not at a very low level, the observed rates of increase will underestimate the maximum net productivity (R_{MAX}). Therefore, until additional data become available, the pinniped default maximum theoretical net productivity rate (R_{MAX}) of 12% will be employed for this harbor seal stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for this stock is calculated as the minimum population estimate (24,705) times one-half the default maximum net growth rate for pinnipeds (½ of 12%) times a recovery factor of 1.0 (for stocks thought to be within OSP, Wade and Angliss 1997), resulting in a PBR of 1,482 harbor seals per year.

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

NMFS observers monitored the northern Washington marine set gillnet fishery during 1993-1998 (Gearin et al. 1994, 2000; P. Gearin, unpubl. data); 1994 observer data recently became available and will be included in a future stock assessment report. For the entire fishery (coastal + inland waters), observer coverage ranged from approximately 40 to 98% during those years. Fishing effort is conducted within the range of both stocks of harbor seals (Oregon/Washington Coast and Inland Washington stocks) occurring in Washington State waters. Some of the animals taken in the inland waters portion of the fishery (see the Inland Washington stock assessment report for details) may have been animals from the coastal stock. Similarly, some of the animals taken in the coastal portion of the fishery may have been from the inland stock. For the purposes of this stock assessment report, the animals taken in the inland portion of the fishery are assumed to have belonged to the Inland Washington stock and the animals taken in the coastal portion of the fishery are assumed to have belonged to the Oregon/Washington Coast stock. However, as noted, some movement of animals between Washington's coastal and inland waters is likely, although data from tagging studies have not shown movement of harbor seals between the two locations (Huber 1995). Accordingly, Table 1 includes data only from that portion of the northern Washington marine set gillnet fishery occurring within the range of the Oregon/Washington Coast stock (those waters south and west of Cape Flattery), where observer coverage was 100% in 1995-1997. No fishing effort occurred in the coastal portion of the fishery in 1993 or 1998. Data from 1993 to 1998 are included in Table 1, although the mean estimated annual mortality is calculated using only the most recent 5 years for which data are

available. The mean estimated mortality for this fishery is 5 (CV=0.52) harbor seals per year from this stock.

The WA/OR/CA groundfish trawl fishery (Pacific whiting component) was monitored for incidental take during 1994-1998. The only harbor seal mortalities occurred in 1996 and 1997, years in which observer coverage (based on observed tons) was 65 and 66%, respectively. Both mortalities occurred during unmonitored hauls and therefore were not used to estimate mortality for the entire fishery in those years. However, observers monitored 100% of the vessels during the fishery and the reported mortalities are thought to be the only harbor seal mortalities in that fishery. The mean estimated mortality from 1994 to 1998 for monitored hauls in this fishery is zero harbor seals per year from this stock, plus 0.4 animals per year from unmonitored haul data.

Table 1. Summary of available information on the incidental mortality and injury of harbor seals (Oregon/Washington Coast stock) in commercial and tribal fisheries that might take this species and calculation of the mean annual mortality rate; n/a indicates that data are not available. All entanglements resulted in the death of the animal. Mean annual takes are based on 1994-98 data unless otherwise noted.

Fishery name	Years	Data type	Percent observer coverage	Observed mortality	Estimated mortality	Mean annual takes (CV in parentheses)
Northern WA marine set gillnet (tribal fishery: coastal waters)	93 94 95 96 97 98	obs data	no fishery n/a 100% 100% 100% no fishery	0 n/a 3 9 13 0	0 n/a 3 9 13 0	5 (0.52)[1]
WA/OR/CA groundfish trawl (Pacific whiting component)	94 95 96 97 98	obs data	53.8% 56.2% 65.2% 65.7% 77.3%	0 0 0 0 0	0 0 0 0 0	0
	96 97	unmonitored hauls		1 1		0.4 (n/a)
WA Grays Harbor salmon drift gillnet	91-93	obs data	4-5%	0, 1, 1	0, 10, 10	6.7 (0.50)
WA Willapa Bay drift gillnet	91-93	obs data	1-3%	0, 0, 0	0, 0, 0	0
				Reported mortalities		
WA Willapa Bay drift gillnet	90-98	self reports	n/a	0, 0, 6, 8, n/a, n/a, n/a, n/a, n/a	n/a	3.5 (n/a) see text
Minimum total annual takes						15.6 (0.36)

[1] 1993 and 1995-98 mortality estimates are included in the average.

The Washington and Oregon Lower Columbia River drift gillnet fishery was monitored during the entire year in 1991-1993 (Brown and Jeffries 1993, Matteson et al. 1993c, Matteson and Langton 1994a). Harbor seal mortalities, incidental to the fishery, were observed only in the winter season and were extrapolated to estimate total harbor seal mortality. However, the structure of the fishery has changed substantially since the 1991-1992 fishing seasons, and this level of take no longer applies to the current fishery (see Appendix 1).

The Washington Grays Harbor salmon drift gillnet fishery was also monitored from 1991-1993 (Herczeg et al. 1992a; Matteson and Molinaar 1992; Matteson et al. 1993a; Matteson and Langton 1994b, 1994c). During the 3-year period, 98, 307 and 241 sets were monitored, representing approximately 4-5% observer coverage in each year. No mortalities were recorded in 1991. In 1992 observers recorded 1 harbor seal mortality incidental to the fishery, resulting in an extrapolated estimated total kill of 10 seals (CV=1.0). In 1993 observers recorded 1 harbor seal mortality incidental to the fishery, though a total kill was not extrapolated. Similar observer coverage in 1992 and 1993 (4.2%

and 4.4%, respectively) suggests that 10 is also a reasonable estimate of the total kill in 1993. Thus, the mean estimated mortality for this fishery from 1991-1993 is 6.7 (CV=0.50) harbor seals per year (Table 1). No observer data are available for this fishery after 1993.

Combining the estimates from the northern Washington marine set gillnet (5), WA/OR/CA groundfish trawl (0 from monitored hauls + 0.4 from unmonitored haul data), and Washington Grays Harbor salmon drift gillnet (6.7) fisheries results in an estimated mean mortality rate in observed fisheries of 12.1 harbor seals per year from this stock.

The Washington Willapa Bay drift gillnet fishery was also monitored at low levels of observer coverage from 1991-1993 (Herczeg et al. 1992a, 1992b; Matteson and Molinaar 1992; Matteson et al. 1993b; Matteson and Langton 1994c, 1994d). In those years, 752, 576, and 452 sets were observed representing approximately 2.5%, 1.4% and 3.1% observer coverage, respectively. No harbor seal mortalities were reported by observers. However, because mortalities were self-reported by fishers in 1992 and 1993, the low level of observer coverage failed to document harbor seal mortalities which had apparently occurred. Due to the low level of observer coverage for this fishery, the self-reported fishery mortalities have been included in Table 1 and represent a minimum mortality estimate resulting from that fishery (3.5 harbor seals per year).

An additional source of information on the number of harbor seals killed or injured incidental to commercial fishery operations is the self-reported fisheries information required of vessel operators by the MMPA. During the period between 1994 and 1998, there were no fisher self-reports of any harbor seal mortalities. However, because logbook records (fisher self-reports required during 1990-94) are most likely negatively biased (Credle et al. 1994), these are considered to be minimum estimates. Self-reported fisheries data are incomplete for 1994, not available for 1995, and considered unreliable after 1995 (see Appendix 4 of Hill and DeMaster 1998).

Other Mortality

Strandings of harbor seals resulting from collisions with boats, from gunshot injuries, or entanglement in line unrelated to fisheries are another source of mortality data. During the 5-year period from 1994 to 1998, human-related mortalities or serious injuries occurred in 1994 (4), 1997 (2) and 1998 (2), resulting in an estimated annual mortality of 1.6 harbor seals (rounded to 2) from this stock during 1994 to 1998. This estimate is considered a minimum because not all stranded animals are found, reported, or examined for cause of death (via necropsy by trained personnel).

Subsistence Harvests by Northwest Treaty Indian Tribes

Several Northwest Indian tribes have developed, or are in the process of developing, regulations for ceremonial and subsistence harvests of harbor seals and for the incidental take of marine mammals during tribal fisheries. The tribes have agreed to cooperate with NMFS in gathering and submitting data on takes of marine mammals.

STATUS OF STOCK

Harbor seals are not considered as "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act. Based on currently available data, the level of human-caused mortality and serious injury (16 + 2 = 18) does not exceed the PBR (1,482). Therefore, the Oregon/Washington Coast stock of harbor seals is not classified as a strategic stock. The minimum total fishery mortality and serious injury for this stock (16; based on observer data (12) and self-reported fisheries information (4) where observer data were not available or failed to detect harbor seal mortality) is also less than 10% of the calculated PBR (148) and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate. The stock size increased until 1992, but has declined in recent years. At this time it is not possible to assess the status of this stock relative to its Optimum Sustainable Population (OSP) level.

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